

TN J **SECOND REVISION EXAMINATION - 2024**
12 - Std **MATHEMATICS**

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Time : 3.00 Hrs

Marks : 90

PART - I

20 X 1 = 20

Note : i) All questions are compulsory. ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer.

- If $A = \begin{pmatrix} 7 & 3 \\ 4 & 2 \end{pmatrix}$ then $9I_2 - A$ is equal to
 a) $\frac{A^{-1}}{2}$ b) A^{-1} c) $2A^{-1}$ d) $3A^{-1}$
- If A is a 3 X 3 matrix such that $|3 \text{ adj } A| = 3$ then the value of $|A|$ is
 a) $\frac{1}{3}$ b) $-\frac{1}{3}$ c) $\pm \frac{1}{3}$ d) ± 3
- If Z_1, Z_2 and Z_3 are complex numbers such that $Z_1 + Z_2 + Z_3 = 0$ and $|Z_1| = |Z_2| = |Z_3| = 1$ then $Z_1^2 + Z_2^2 + Z_3^2$ is
 a) 3 b) 2 c) 0 d) 0
- If $x = \frac{-1 + i\sqrt{3}}{2}$ then the value of $x^2 + x + 1$ is
 a) 2 b) $\frac{1}{2}$ c) 1 d) 0
- If α, β and γ are the zeros of $x^3 + px^2 + qx + r$ then $\sum \frac{1}{\alpha}$ is
 a) $\frac{q}{r}$ b) $-\frac{p}{r}$ c) $-\frac{q}{r}$ d) $-\frac{q}{p}$
- The number of positive zeros of the polynomial $\sum_{r=0}^n {}^n C_r (-1)^r x^r$ is
 a) $< n$ b) 0 c) r d) n
- $\sin^{-1}(2 \cos^2 x - 1) + \cos^{-1}(1 - 2 \sin^2 x) =$
 a) $\frac{\pi}{4}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{6}$
- The range of $\sec^{-1} x$ is
 a) $[0, \pi] \setminus \left\{ \frac{\pi}{2} \right\}$ b) $[0, \pi]$ c) $\left[\frac{-\pi}{2}, \frac{\pi}{2} \right]$ d) $\left(\frac{-\pi}{2}, \frac{\pi}{2} \right)$
- If $x + y = k$ is a normal to the parabola $y^2 = 12x$ then the value of K is
 a) 9 b) -1 c) 3 d) 1

10. The equation of the plane passing through (3, 4, 5) and parallel to the plane $x + 2y - 2z - 9 = 0$ is
 a) $x + 2y - 2z = 4$ b) $x + 2y - 2z = 3$
 c) $x + 2y - 2z = 1$ d) $x + 2y - 2z = 5$
11. A stone is thrown up vertically. The height it reaches at time t seconds is given by $x = 80t - 16t^2$. The stone reaches the maximum height in time t seconds is given by
 a) 3.5 b) 3 c) 2.5 d) 2
12. The minimum value of the function $|3 - x| + 9$ is
 a) 9 b) 6 c) 0 d) 3
13. If $v(x,y) = \log(e^x + e^y)$ then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y}$ is equal to °
 a) $\frac{1}{e^x + e^y}$ b) $e^x + e^y$ c) 1 d) 2
14. The approximate change in the volume V of a cube of side x metres caused by increasing the side by 1% is
 a) $0.3x dx m^3$ b) $0.03x m^3$ c) $0.03x^2 m^3$ d) $0.03x^3 m^3$
15. The value of $\int_0^1 \log\left(\frac{x}{1-x}\right) dx$ is a) 0 b) 2 c) 4 d) 3
16. The area between $y^2 = 4x$ and its latus rectum is
 a) $\frac{8}{3}$ b) $\frac{2}{3}$ c) $\frac{5}{3}$ d) $\frac{4}{3}$
17. The order and degree of the differential equation $\frac{d^2 y}{dx^2} + \left(\frac{dy}{dx}\right)^{1/3} + x^{1/4} = 0$ are respectively
 a) 2, 6 b) 3, 3 c) 2, 3 d) 2, 4
18. The solution of $\frac{dy}{dx} + p(x)y = 0$ is
 a) $x = ce^{\int p dx}$ b) $x = ce^{-\int p dx}$ c) $y = ce^{\int p dx}$ d) $y = ce^{-\int p dx}$
19. A random variable x has binomial distribution with $n = 25$ and $p = 0.8$ then standard deviation of x is
 a) 6 b) 4 c) 3 d) 2
20. The proposition $P \wedge (\neg p \vee q)$ is
 a) a tautology
 b) a contradiction c) logically equivalent to $p \wedge q$ d) logically equivalent to $p \vee q$

PART - II

Note : i) Answer any seven of the following. ii) Question no 30 is compulsory. 7 X 2 = 14

21. If A is a non - singular matrix of odd order prove that $|\text{adj } A|$ is positive
22. Find the square root of $6 - 8i$.

23. If α and β are roots of the quadratic equation $2x^2 - 7x + 13 = 0$. Construct a quadratic equation whose roots are α^2 and β^2 .
24. Find the principal value of $\tan^{-1}(-\sqrt{3})$.
25. Find the angle between the straight line $\vec{r} = (2\hat{i} + 3\hat{j} + \hat{k}) + t(\hat{i} - \hat{j} + \hat{k})$ and the plane $2x - y + z = 5$
26. If $U(x, y) = \frac{x^2 + y^2}{\sqrt{x + y}}$ Prove that $x \frac{\partial u}{\partial y} + y \frac{\partial u}{\partial x} = \frac{3}{2}u$
27. Solve. $\frac{dy}{dx} = \sqrt{\frac{1 - y^2}{1 - x^2}}$
28. The probability that a certain kind of component will survive a electrical test is $\frac{3}{4}$. Find the probability that exactly 3 of the 5 components tested service.
29. $A = \begin{pmatrix} 0 & 1 \\ 1 & 1 \end{pmatrix}$ $B = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$ be any two boolean matrices of the same type Find $A \vee B$ and $A \wedge B$.
30. Evaluate: $\lim_{x \rightarrow 0} \frac{\sin mx}{\sin nx}$

PART- III

Note: i) Answer any seven questions.

ii) Question no.40 is compulsory.

7 X 3 = 21

31. Find the adjoint matrix of $A = \begin{pmatrix} 1 & 3 \\ 2 & -5 \end{pmatrix}$ then verify $A (\text{Adj } A) = (\text{adj } A) A = |A|I_2$
32. Find the polynomial equation of minimum degree with rational co -efficients having $\sqrt{5} - \sqrt{3}$ as a root.
33. Find the centre and radius of the circle $3x^2 + (a + 1)y^2 + 6x - 9y + a + 4 = 0$.
34. Find the local extremum of the function $f(x) = x^4 + 32x$.
35. The radius of a sphere with radius 10 cm has to decrease by 0.1 cm approximately how much will its volume decrease.
36. Evaluate $\int_2^3 \frac{\sqrt{x} dx}{\sqrt{5-x} + \sqrt{x}}$
37. Solve. $x \frac{dy}{dx} + y = x \log x$
38. If μ and σ^2 are mean and variance of the discrete random variable x and $E(x + 3) = 10$ and $E(x + 3)^2 = 116$. Find μ and σ^2 .

39. Let A be $\mathbb{Q} - \{1\}$ define * on A by $x * y = x + y - xy$. Is * is a binary on A?
40. $w \neq 1$ is a cube root of unity and $(1 + w)^7 = A + Bw$ then find A and B.

PART- IV

Note : Answer all the questions.

7 X 5 = 35

41. a) Solve the following systems of linear equations by Cramer's rule.

$$\frac{3}{x} - \frac{4}{y} - \frac{2}{z} - 1 = 0, \frac{1}{x} + \frac{2}{y} + \frac{1}{z} - 2 = 0, \frac{2}{x} - \frac{5}{y} - \frac{4}{z} + 1 = 0 \quad (\text{OR})$$

- b) Draw the curves $\sin x$ and $\sin^{-1}x$ in the respective principal domain.

42. a) If $z = x + iy$ and $\arg\left(\frac{z-i}{z+2}\right) = \frac{\pi}{4}$ show that $x^2 + y^2 + 3x - 3y + 2 = 0$. (OR)

- b) If the curves $ax^2 + by^2 = 1$ and $cx^2 + dy^2 = 1$ intersect each other orthogonally

then show that $\frac{1}{a} - \frac{1}{b} = \frac{1}{c} - \frac{1}{d}$.

43. a) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ Prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \tan u$. (OR)

- b) The equation of electromotive for a electric circuit containing resistance and self

inductance is $E = Ri + L \frac{di}{dt}$ Where E is electromotive forces is given to the circuit

R the resistance and L the co-efficient of induction. Find the current i at time t when $E = 0$.

44. a) Find the area of the region bounded between the parabola $x^2 = y$ and the curve $y = |x|$. (OR)

- b) Prove by vector method $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$.

45. a) Solve: $x^4 - 10x^3 + 26x^2 - 10x + 1 = 0$ (OR)

- b) Prove that among all the rectangles of the given area square has the least perimeter.

46. a) A random variable X has the following probability mass function.

x	1	2	3	4	5
f(x)	k^2	$2k^2$	$3k^2$	$2k$	$3k$

Find i) k ii) $p(2 \leq x < 5)$ iii) $p(3 < x)$. (OR)

- b) Using truth table check whether the statements $\neg(p \vee q) \vee (\neg p \wedge q)$ and $\neg p$ are logically equivalent.

47. a) A tunnel through a mountain for a four lane highway is to have a elliptical opening. The total width of the highway (not the opening) is to be 16 m and the height at the end of the road must be sufficient for a truck 4m high to clear if the highest point of the opening is to be 5m approximately. How wide must the opening be? (OR)

- b) Find the Vector and Cartesian equations of the plane passing through the point $(-2, -2, 4)$ and perpendicular to the planes

$$6x + 4y - 6z = 5 \text{ and } 10x - 8y + 2z = 1.$$